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UNIONIDÆ OF OHIO AND ALABAMA.

BY JAMES LEWIS, M.D.

In the Ohio River and its tributaries are found a very considerable number of species of Unionidæ, a large proportion of which are regarded as types by means of which similar shells of other regions are identified. In Central Alabama occur about thirty species of Unionidæ that are identical with or equivalent to a similar number of species of the Ohio drainage. Possibly an exhaustive study of the species of Tennessee would increase this list to forty or more species. The occurrence of identical and equivalent species in the two systems of drainage suggests the probability that a careful scrutiny of some of the *equivalent* species may afford some assistance in simplifying the study of these things by indicating synonymy hitherto unsuspected. The identical species of the two regions, so far as have been compiled, are embraced in the following list:—

Unio Anodontoides, Lea.	U. obliquus, Lam.
U. camptodon, Say.	U. plenus, Lea.
U. cornutus, Barnes.	U. pyramidatus, Lea.
U. crassidens, Lam.	U. rectus, Lam.
U. ebenus, Lea.	U. securis, Lea.
U. elegans, Lea.	U. tuberculatus, Barnes.
U. metanever, Raf.	Margaritana complanata, Barnes.

Of the shells common to the Ohio and Alabama drainage it may be unnecessary to speak at length of more than one species, *U. crassidens*, Lam., which may be considered the type of a somewhat numerous group of species of shells of solid structure, dark epidermis, dark purple nacre, and having folds more or less strongly indicated on the posterior slope. The following are some of the more prominent members of the group:—

U. pliciferus, Lea.	Mexico.	U. Monroensis, Lea.	Lake Monroe,
U. incrassatus, Lea.	Chattahoochee		Florida.
	River, Ga.	U. Forbesianus, Lea.	Savannah
U. fraternus, Lea.	Chattahoochee		River, Ga.
	River, Ga.		etc. etc. etc.
U. Anthonyi, Lea.	Florida.		

The distribution of *crassidens* seems to extend to many of the more conspicuous rivers of the Gulf States west of Florida; to all

the principal tributaries of the Ohio. Most of the other recognized species of this group are quite local, and do not occupy an extensive area. There are in this group indications that the future student of synonymy may find much to interest him.

Unio fraternus, Lea, appears to be simply a variety of *incrasatus*, as intermediate specimens of every degree seem to be abundant in the Chattahoochee River.

Among the most conspicuously *equivalent* species are the following:—

OHIO SYSTEM.

U. alatus, Lea.
U. brevidens, Lea.
U. circulus, Lea.
U. clavus, Lamarck.

U. Conradianus, Lea.

U. Cooperianus, Lea.
U. gibbosus, Barnes.

U. glans, Lea.

U. Kirtlandianus, Lea.

U. lachrymosus, Lea.
U. lævissimus, Lea.
U. lenoir, Lea.

U. luteolus, Lam.

U. multiplicatus, Lea.
U. ovatus, Say.
U. parvus, Barnes.

ALABAMA SYSTEM.

U. purpuratus, Lamarck.
U. penitus, Con.
U. castaneus, Lea.
U. decisis, Lea.
U. interventus, Lea.
U. consanguineus, Lea.
U. crebrivittatus, Lea.
U. Chattanoogaensis, Lea.
U. acutissimus, Lea.
U. parvulus, Lea.
U. rubellinus, Lea.
U. asperatus, Lea.
U. subgibbosus, Lea.
U. sublatus, Lea.
U. Cromwellii, Lea.
U. corvunculus, Lea.
U. glandaceus, Lea.
U. verus, Lea.
U. instructus, Lea.
U. asper, Lea.
U. inflatus, Lea.
U. metastratus, Con.
U. compactus, Lea.
U. stramineus, Con.
U. Claibornensis, Lea.
U. pallescens, Lea.
U. Gouldii, Lea.
U. Boykinianus, Lea.
U. excavatus, Lea.
U. granulatus, Lea.
U. germanus, Lea.

OHIO SYSTEM.

U. phaseolus, Hildreth.

U. plicatus, Barnes.

U. rubiginosus, Lea.

U. undulatus, Barnes.

ALABAMA SYSTEM.

U. Greenii, Lea.

U. flavescens, Lea.

U. simplex, Lea.

U. trinacrus, Lea.

U. Foremanianus, Lea.

U. Woodwardianus, Lea.¹

U. atro-costatus, Lea.

U. Elliottii, Lea.

U. negatus, Lea.

U. late-costatus, Lea.

On comparing the shells of the two regions indicated, it will be found generally true that the shells of the Ohio system, especially of that portion north of the Ohio River, attain a more luxuriant development and have a more brilliant epidermis, in which the rays are more numerous and more persistent, than in the shells of Alabama. There are also conspicuous differences in form, even in some of the species that are acknowledged to be identical in the two regions.

Some of the species that are here presented as equivalents of species of the Ohio system are represented by other analogous forms or equivalents in contiguous territory in the same latitude with Central Alabama.

Unio purpuratus extends westward into Texas and Arkansas. So far as known *U. penitus* has been reliably quoted only as found in the Alabama River, possibly also in the Coosa River, which is practically the same thing. *Unio decusus* is said to occur in Mississippi as well as in Alabama. *Unio consanguineus*, *U. crebri-vittatus* and *U. Chattanoogaensis* are quoted as found in Georgia and Alabama. The equivalents of *U. Conradianus* have been quoted as occurring in several streams in Alabama. One, *U. rubellinus*, also occurs in Georgia. Another, not included in the above list (*U. penicillatus*), is found in the Chattahoochee River.

A shell of this type also occurs in the Black Warrior River, in which stream also occur other Uniones, whose geographical distribution is nearly the same. The range of the shells of this type in Alabama and Georgia reaches fully across the State of Alabama. Whether similar shells are also found in the rivers of Mississippi does not appear in any records that have been consulted

¹ Georgia.

in the preparation of this paper. Through correspondence and records the distribution of *U. Conradianus* is found to reach the northern portions of Georgia and Alabama, a considerable portion of East Tennessee, and a few streams in Kentucky.

Unio Cooperianus, Lea, besides finding an equivalent in *U. asperatus*, seems also to be represented elsewhere in the same or a similar manner by *U. pernodosus*. *U. asperatus* occurs in the Coosa, Alabama, and Black Warrior Rivers, in each of which streams it exhibits local peculiarities, more marked, perhaps, in the Black Warrior River than in the other two streams named.

Unio gibbosus, Barnes, is very fairly represented in the Coosa River by shells having white nacre to which Mr. C. M. Wheatley, of Phoenixville, Pa., gives the name *U. subgibbosus*, Lea. Whether this nomenclature has the sanction of Mr. Lea has not been stated. The typical *U. sublatus* is found in Uchee Creek, in southeastern Alabama, and also on Uchee Bar in the Chattahoochee River. Specimens identified by records and types have been found in Shoal Creek at Montevallo, Ala. The beaks of the Shoal Creek specimen have undulations such as are found on the perfect beaks of young *gibbosus*. In another stream near Montevallo (Buck Creek) is found another variety more slender in form, with darker epidermis and nacre, and more decided undulations in the beaks. In the series of specimens that have been examined as recorded above, the near relation of *U. sublatus* to *gibbosus* is very clearly shown. Of *Unio glans*, *Cromwellii* and *corvunculus* little can be said at this time for the reason that but few specimens from any one locality have been examined in this connection. The two species last named occur at Montevallo and in Northern Georgia.

The shells quoted as the equivalents of *U. Kirtlandianus* occur in the Cahawba River and in Buck Creek. Mr. Lea quotes only the Cahawba River. The shells are very much alike, the chief differences seeming to be due to age and local influences. They have much the same flattened form as *Kirtlandianus*, and the undulations on the beaks of the young shells are such as occur in *Kirtlandianus*; in outline there are conspicuous differences, though the Alabama shells agree very closely with each other in form character of the epidermis, muscular and pallear impressions, teeth and nacre.

In the relation of *U. asper* to *U. lachrymosus* differences may be observed which are, in many respects, such as might be pointed

out in some of the species of Alabama identical with Ohio species. Many of the Alabama *Uniones* that are identical with Ohio species exhibit peculiarities that one readily and intuitively ascribes to local influences. Some of them are of smaller *size*; those species which in Ohio are beautifully and conspicuously marked with rays, in Alabama are found without rays, or the rays appear only on the umbo and are lost by erosion as the shell matures. In other instances the rays appear only as a periodical phenomenon, a row of distant spots down the posterior angle, disappearing before they reach the margin of the adult shell. This phenomenon is faintly hinted in many of the shells of Tennessee, and makes its full appearance only in Georgia, Alabama, and other States in the same latitude. Local influences must affect every species in a greater or less degree.

In quoting *asper* as an equivalent of *lachrymosus* the parallelism is suggested and verified by specimens of *lachrymosus* from the Illinois River. In these specimens the forms and colors, and other peculiarities of *asper*, are approximated in a very suggestive manner. The Illinois shells, however, though smaller than Ohio River shells, are larger than the typical *asper*. *U. asper* itself varies in different localities, and among its most prominently variable features are its *size* and roughness of surface. The relations of *asprerrimus* to these shells seem to require that it be mentioned here. *Unio lævissimus* and *U. inflatus* are obviously nearly related. The chief and most conspicuous difference is in the relative diameter of the two shells.

Unio lenior, quoted by Mr. Lea as a Tennessee shell, seems to be represented in the Black Warrior River by the female of a small species belonging to the same group with *U. penitus*, Con. Shells recently received from the Black Warrior fully corroborate Mr. Lea's remark on *U. metastriatus*, Con., at the bottom of page 40 in his Synopsis of 1870, and make its identification complete.¹ This is the female of the same species to the male of which Mr. Lea gave the name *U. compactus*. It has been found in the Black Warrior, Cahawba, and other rivers and creeks in Alabama. Mr. Lea's type of *compactus* was from Georgia. The shells vary from each other in different streams, as is the universal habit of this class of mollusks.

¹ Conrad's *metastriatus* is a Black Warrior River shell.

Unio luteolus, Lam., does not seem to have been recorded as occurring in any stream much south of the latitude of the Ohio River.¹ It may possibly occur in some of the rivers of Kentucky; it is regarded as one of the most variable species occurring in water north of the Ohio. A lacustrine variety described by Mr. Anthony received the name *U. distans*, Anth.

Mr. Lea in his Synopsis (1870) has put *distans* in the synonymy of *radiatus*. The error was probably accidental. In southern latitudes the typical *luteolus* is unknown,² and in its place are found equivalents to which the following names and local references have been assigned:—

<i>Unio obtusus</i> , Lea. Chattahoochee River, Ga.	<i>U. Gouldii</i> , Lea. Tuscaloosa, Ala.
<i>U. Claibornensis</i> , Lea. Alabama River, Ala.	<i>U. approximatus</i> , Lea. Red River, La.
<i>U. stramineus</i> , Con. Various small streams in Alabama, etc.	<i>U. Reeveianus</i> , Lea. Alexandria, La.
<i>U. pallescens</i> , Lea. Black Warrior River, Ala.	<i>U. Hydianus</i> , Lea. Bayou Teche, La.

In the progress of the investigations made in this behalf, specimens of this group of shells have been carefully compared, and a liberal interpretation has been given to records of species.

It has been suggested that *Unio callosus*, Lea, may find a fitting place in the above list of equivalents of *luteolus*. Of the value of *callosus* as a species, nothing is known beyond the record. The relations conjectured between *U. multiplicatus* and *U. Boykinianus* may not be confirmed. Between *U. multiplicatus* and *U. Eightsii* from Texas, relations are more apparent. *U. Boykinianus* has a somewhat wide distribution, being known to occur in the Alabama and Tombigbee Rivers as well as in the Chattahoochee. Possibly specimens may yet be found in Louisiana and Texas, to make its relation with *multiplicatus* more apparent.

Unio ovatus, Say, has probably more intimate relations with southern shells of the same type than the differences in names would imply. *U. excavatus*, Lea, found in Mississippi, Alabama, and Georgia, is represented in the Chattahoochee River by a diminutive form of the same type. The typical *ovatus* is a triangularly ovate shell, posteriorly truncate, with epidermis nearly devoid of

¹ *U. luteolus* is quoted from Texas, Obs. XI. 31.

² See Obs. XI. 31.

rays. A slightly more rotund form having rays and often pink nacre is Mr. Barnes's *U. ventricosus*. A form still more rotund is Mr. Lea's *U. occidentis*, the male of which many intelligent collectors believe to be his *subovatus*; while *U. capax*, Green, is a very globose shell, scarcely marked with rays, and having the cardinal teeth very much compressed and directed obliquely forward, nearly parallel with the anterior dorsal margin of the shell. *Unio satur*, Lea, seems to be very nearly related to *capax*. *Unio Canadensis*, Lea, is apparently very nearly related to *occidentis*. It differs by being quite as much compressed as *U. cariosus*, and nearly of the same form. The beaks are more coarsely undulate than in any other shell of this group. *U. Canadensis* is probably a northern equivalent of *occidentis*. It occurs in Wisconsin as well as in the river St. Lawrence.

Uniones of the type of U. parvus, Barnes. There are on record nineteen species of Uniones which have relations to each other seeming to warrant their association in this group. In geographical distribution they extend over a large area north and south in the United States and both sides of the Mississippi River. The typical *parvus* is known to exhibit considerable diversity of appearance, form, and size. One variety of this species found in Indiana is so remarkable for its luxuriant development as to have acquired the familiar designation of "The big parvus of the Wabash." This variety differs also from the type by having the nacre sometimes tinted of a salmon color, the nacre of the type being white. Most of the species of this group also have white nacre. Two, however (possibly having more intimate relations with *U. glans*, Lea), have purple nacre. These are the species *Cromwellii* and *corvunculus*. Another species has been characterized as having salmon-colored nacre, namely, *U. Bealei*. Two other species, clearly members of this group, have been described as having "purplish" nacre; these are *granulatus* and *germanus*. The soft parts of three species have been found to exhibit, near the branchial opening, a black, spongy, fleshy mass that Mr. Lea calls "caruncle." This has been observed only in females of *parvus*, *granulatus*, and *paulus*. The differences of form usually observed in the sexes are less conspicuously observable in *parvus* (as found in the Ohio system of drainage) than in some of the other species of this group. *Unio pygmæus* is probably figured from a male specimen; the female may possibly have the form of

granulatus. Shells from North Carolina distributed by Mr. C. M. Wheatley to his correspondents under the name of *granulatus* seem to warrant this conjecture.

That Mr. Lea regards some of the forms included in this group as being possibly synonyms of others, is indicated in his Synopsis, 1870, p. 49, foot note 3; and also in his remarks on species in "Observations" VIII., 41 and 43.

Two species, members of this group (*paulus* and *corvinus*), are credited to the Chattahoochee and Flint Rivers in Georgia. It should be remembered that these two streams are parts of one system of drainage, and that they have many species of *Uniones* in common.

The species *Johannis* and *flavidulus* may ultimately prove not to be legitimate members of this group, as they exhibit peculiarities of form in which they resemble each other, while they are in some respects quite different from all the other species with which they are here provisionally associated.

In compiling notes on a group of species, it might by some persons be thought excusable to suggest synonymy in those instances in which strong resemblances are apparent. But synonymy is not to be hastily inferred, as there are also *differences*, some of which are too important to be ignored. The most that can be done at present is to call attention to *groups of species* in a manner to encourage a thorough study of them. It seems also necessary that inquiries should be directed particularly to geographical distribution and the local association of species; also to the local influences that modify species, and to the extent to which a species may be susceptible to modifying influences. Synonymy and the hypothesis of evolution may contend for the result in the final treatment of this and other groups of *Uniones*. To aid the student who may desire to know what has been recorded of the group of species now under consideration, the following table of references is appended:—

Unio parvus, *Barnes*. Ohio, etc.¹ American Jour. Sci. 1823. Lea's Observations—(soft parts) VII. 39; (Embryos) VII. 39; (Miscellaneous References) I. 23, 26, 27, 34, 54, 97, 213; II. 55, 128; III. 52, 69, 70, 85; IV. 35; V. 18, 25; VI. 20; VIII. 44, 101; IX. 27; XI. 24, 31, 54; XII. 15, 19, 69, 71, 75, 87; XIII. 42.

¹ Besides having been found in the Ohio River and its tributaries, Mr. Lea in his "Observations" quotes *parvus* as occurring in Mississippi (VII. 39) and in Texas (XI. 31).

- U. granulatus*, Lea. Big Prairie Creek, Ala. Jour. Acad. Nat. Sci. VI. 48; Obs. XI. 52; Synopsis, 1870, p. 49, foot note 2.
- U. germanus*, Lea. Coosa River, Ala. Jour. A. N. S. VI. 49; Obs. XI. 53; (soft parts) XI. 54; (Miscell. Ref.) XII. 45.
- U. paulus*, Lea. Chattahoochee River, Ga. Trans. Am. Phil. Soc. VIII. pl. 15, f. 29; Obs. III. 51; (soft parts) X. 38; (Embryo) VII. 40; X. 39; (Miscell. Ref.) VIII. 26; XII. 19, 71, 75.
- U. corvinus* Lea. Flint River, Ga. Jour. A. N. S. VI. 310; Obs. XII. 70.
- U. Johannis*, Lea. Connasauga River, Ga.; Etowah River, Ga.; Alabama River, Ala. Jour. A. N. S. IV. 343; Obs. VIII. 25.
- U. flavidulus*, Lea. Columbus, Miss. Jour. A. N. S. V. 97; Obs. VIII. 101.
- U. Texasensis*, Lea. DeWitt Co., Texas. Jour. A. N. S. IV. 359; Obs. VIII. 41.
- U. Bairdianus*, Lea. Devil's River, Texas. Jour. A. N. S. VI. 361; Obs. VIII. 43.
- U. Bealei*, Lea. Leon Co., Texas. Jour. A. N. S. V. 204; Obs. IX. 26.
- U. corvunculus*, Lea. Swamp Creek, Whitfield Co., Ga. Jour. A. N. S. VI. 315; Obs. XII. 74.
- U. Cromwellii*, Lea. Kiokee Creek, Dougherty Co., Ga. Jour. A. N. S. VI. 258; Obs. XII. 18.
- U. marginis*, Lea. Blue Springs, Dougherty Co., Ga. Jour. A. N. S. VI. 255; Obs. XII. 15.
- U. apicinus*, Lea. Othalooga Creek, Gordon Co., Ga. Jour. A. N. S. IV. 76; Obs. VI. 76.
- U. ineptus*, Lea. Abbeville District, S. C. Trans. Am. Phil. Soc. X. pl. 15, f. 12, Obs. V. 17; XI. 25.
- U. pygmæus*, Lea. Abbeville District, S. C. Trans. Am. Phil. Soc. X. pl. 15, f. 14; Obs. V. 18.
- U. vesicularis*, Lea. Lake Ocheechobee, Florida. Jour. A. N. S. VIII.; Obs. XIII. 41.
- U. minor*, Lea. Lakes Monroe and George, Florida. Trans. Am. Phil. Soc. IX. pl. 39, f. 3; Obs. IV. 34.
- U. trossulus*, Lea. Lake Monroe, Florida. Trans. Am. Phil. Soc. IX. pl. 40, f. 6; Obs. IV. 36.

Unio phaseolus, Hildreth, as found in northern waters, presents considerable diversity of form and appearance, but nowhere loses its identity north of the Ohio. In the Indian Territory varieties are found which exhibit peculiarities which might puzzle an inexperienced student. Something similar has been found in some of the streams near the southwestern part of Tennessee. In these divergent specimens the characteristic form of the species becomes somewhat obscured, and the rays are capillary. They diverge, indeed, from the typical *phaseolus* in the direction of its southern equivalents, as exhibited in the rivers of Alabama.

Unio velatus, Conrad, which Mr. Lea puts in the synonymy of *Foremanianus*, is quoted from "the river St. Foies." Mr. Conrad makes *U. simplex*, Lea, a synonym of *U. Greenii*, Con. Mr. Lea, in his Synopsis (1870), foot note 1, page 43, is evidently of the opinion that *U. Greenii* and *U. flavescens* are varieties of one species; an opinion that is clearly entitled to the highest consideration. It is possible that some future writer may be able to show that all the Alabama equivalents of *phaseolus* are entitled to be placed in the same category with *Greenii* and *flavescens*.

Unio plicatus, Barnes,¹ has a considerable number of southern equivalents, besides the two quoted for Alabama.

Southern equivalents of *U. plicatus*, Barnes, and original localities.

<i>U. perplicatus</i> , Con.	Jackson, La.	<i>U. Lincecumii</i> , Lea.	Dallas Co.,
<i>U. atro-costatus</i> , Lea.	Claiborne,	Texas, and Brazos River,	Texas.
Ala.		<i>U. Brazosensis</i> , Lea.	Dallas Co.,
<i>U. Elliottii</i> , Lea.	Othcalooga Creek,	Texas.	
Geo.		<i>U. pauciplicatus</i> , Lea.	Austin, Texas.

Unio hippopæus, Lea, Lake Erie, seems to be a northern lacustrine form, entitled to a place as a member of the group.

U. perplicatus, Con., has a somewhat extensive geographical distribution, and is a very well-known shell. *U. atro-costatus*, Lea, which is sometimes confounded with *perplicatus*, occurs in the Coosa River. Specimens referable to this species have been taken in the Cahawba.

U. Elliottii, Lea, seems to be represented in the Cahawba River by shells of the characteristic form, but of less size than the type. Shells that would be quite readily identified as *U. pauciplicatus*, Lea, occur in the Upper Black Warrior River.

Of *U. negatus*, Lea, not much needs to be remarked. The species is set apart from *rubiginosus*, Lea, out of regard to the peculiar undulations of the beaks. The beaks of different varieties of *rubiginosus* exhibit considerable diversity of appearance. The species is very widely distributed, and assumes a wonderful variety of forms.

U. undulatus, Barnes, is represented in Alabama by *U. late-costatus*, Lea, which is credited by Mr. Lea to Tuscaloosa. Shells

¹ Mr. Barnes was the first person to describe *U. plicatus*, though it had been on record, without description, earlier.

of this type occur in various streams in the vicinity of Selma and Montevallo. Cahawba River, Buck Creek, and Bogue Chitto Creek, are among those remembered. One adult specimen from Bogue Chitto Creek has the characteristic folds, but not the form of a smaller shell of this group (*U. Neislerii*, Lea) found in Flint River, Georgia. While the subject is yet fresh, it may not be out of place to inquire whether *U. undulatus* is other than an equivalent of *plicatus*? Do the two forms maintain their integrity? And is there any well-attested instance of their occurring in one locality together, each preserving its identity?

Referring back to *U. plicatus* and its equivalents, more especially to those in which the folds have become nearly or quite obsolete, it may not be out of place to remark that there is a specimen of unmistakable *plicatus* from the Ohio River, in the National Museum at Washington (Smithsonian Institution), *entirely destitute of folds*.